

NO Loop



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(54) **SEMICONDUCTOR LASER HIGHPOWER AMPLIFIER SYSTEM**

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(58) Field of Search **372/6; 359/179, 359/341**

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,964,242 A	10/1990	Ruble et al.	51/144
5,062,021 A	10/1991	Ranjan et al.	360/135
5,088,240 A	2/1992	Ruble et al.	51/165

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

EP	0 685 946 A1	12/1995
EP	0 729 207 A	8/1996
WO	WO 86 02301 A	4/1986

OTHER PUBLICATIONS

D. Taverner et al., "158 mJ pulses from a single transverse mode large area erbium doped fiber amplifier", *Optics Letters*, vol. 22, No. 6, Mar. 15, 1997, Washington.

B. Desthieux et al., "111 KW (0.5mJ) pulse amplification at 1.4 μ m using a gated cascade of three erbium doped fiber amplifiers" *Applied Physics Letters*, vol. 63, No. 5, Aug. 2, 1993, New York, US.

(List continued on next page.)

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(57) **ABSTRACT**

A high power laser optical amplifier system for material processing comprises multiple stage fiber amplifiers with rejection of propagating ASE buildup in and between the amplifier stages as well as elimination of SBS noise providing output powers in the range of about 10 μ J to about 100 μ J or more. The system is driven with a time varying drive signal from a modulated semiconductor laser signal source to produce an optical output allowing modification of the material while controlling its thermal sensitivity by varying pulse shapes or pulse widths supplied at a desire repetition rate via modulation of a semiconductor laser signal source to the system to precisely control the applied power application of the beam relative to the thermal sensitivity of the material to be processed. The high power fiber amplifier system has particular utility in high power applications requiring process treatment of surfaces, such as polymeric, organic, ceramic and metal surfaces, e.g., material processing, surface texturing, heat treatment, surface engraving, fine micro-machining, surface ablation, cutting, grooving, bump forming, coating, soldering, sealing, surface diffusion and surface conversion to a compound. A particular example is given for texturing of disk surfaces of magnetic disk media prior to the deposition or coating of a thin magnetic film on the textured surfaces to prevent slider stiction.

22 Claims, 6 Drawing Sheets

